

Charge to the Independent Workshop Panel

Salmonid Integrated Life Cycle Models Workshop

Orientation and Focus

The National Marine Fisheries Service's (NMFS) 2009 Biological Opinion (NMFS Opinion) on the Operations Criteria and Plan (OCAP) of the Central Valley Project and State Water Project describes the adverse impacts of water operations on the ESA-listed anadromous fish species (Chinook salmon, steelhead, and green sturgeon) and specific actions, i.e., reasonable and prudent alternatives (RPAs), to mitigate those impacts. Various peer reviews of the NMFS Opinion (*i.e.*, October 22, 2004 final, and December 11, 2008 draft¹), the Independent Review of the Central Valley Project Improvement Act Fisheries Program² and the National Academy of Sciences' March 19, 2010, report³ have confirmed the need for integrated life cycle modeling in order to determine the effects of proposed water operations and the effectiveness of prescribed actions on listed anadromous fish species. Also, recent court decisions have examined the validity of certain NMFS Opinion actions because they do not consider the whole life cycle of the protected species.

The U.S. Bureau of Reclamation (Reclamation) and the California Department of Water Resources used three salmon mortality and life cycle models to evaluate the effects of proposed water operations on listed salmon species in the OCAP Biological Assessment. NMFS considered these three models (Reclamation Salmon Mortality Model, SALMOD, and Interactive Object-Oriented Salmon simulation (IOS) Winter-Run Life Cycle Model) in the development of the NMFS Opinion and proposed RPA actions. NMFS determined that the IOS model was not useful for considering how winter-run Chinook salmon are expected to respond to implementation of the proposed actions and did not use the IOS model results in the OCAP Opinion because the model received a poor review by the NMFS Science Center. However, the 2008 independent review questioned this conclusion and suggested reconsideration of the IOS model for the final 2009 NMFS Opinion. Life cycle models for steelhead and green sturgeon were not used in the NMFS Opinion because these models have yet to be developed. To date, life cycle models that consider the effects of water operations and RPA actions on multiple species' life cycles have yet to be well incorporated into decision making.

¹ CALFED Independent Review of a Draft Version of the 2009 NMFS OCAP Biological Opinion. January 2009.

² Listen to the River: An Independent Review of the CVPIA Fisheries Program. December 2008

³ "A Scientific Assessment of Alternatives for Reducing Water Management Effects on Threatened and Endangered Fishes in California's Bay Delta" 2010.

NMFS and the implementing agencies of the NMFS Opinion have identified the need to better integrate life cycle models into their assessments of the effects of water operations on the listed anadromous fish species and the effectiveness of prescribed RPA actions to protect and recover the listed anadromous fish species. NMFS and the implementing agencies are interested in improving their understanding of existing life cycle models and obtaining recommendations on how these life cycle models could be best integrated into a decision making framework for adapting water operations and prescribed RPA actions for individual and multiple species.

At the request of NMFS, the Delta Science Program will host a public workshop on integrated life cycle models. The workshop will focus primarily on salmonid life cycle models, however, the panel will consider how these models could be used or integrated to evaluate the effects of water operations on other fish species in the Central Valley.

This workshop will focus on:

- a. Summarizing various life cycle models;
- b. Providing information on the most appropriate model(s) for informing NMFS and implementing agencies of the effects of water operations and prescribed actions on salmonids at various life stages and at the population level;
- c. Providing information on how to integrate multiple specific models (e.g. geographically specific, life-stage specific, etc.) to address the effects of water operations and prescribed RPA actions on the whole life cycle of salmonids;
- d. Evaluating how well the presented models can be adapted for other fish species;
- e. Providing insight into decision-making frameworks for using life cycle models (at appropriate temporal and spatial scales) to adapt water operations and prescribed RPA actions for individual and multiple species.

Background Reading Materials

Each independent workshop panelist will examine the following documents prior to attending a one-day public meeting: These reports will be provided in electronic format.

Primary Documents Organized by Model

- OBAN
 - Hendrix, N. (2008). A Statistical Model of Central Valley Chinook Incorporating Uncertainty: Description of Oncorhynchus Bayesian Analysis (OBAN) for winter run Chinook. R2 Resource Consultants, Inc.

- Lessard, R.B, N. Hendrix, et al. (in press). Environmental factors influencing the population viability of Sacramento River Winter Run Chinook salmon (*Oncorhynchus tshawytscha*).
- Shiraz
 - Scheuerell, M. D., R. Hilborn, et al. (2006). "The Shiraz model: a tool for incorporating anthropogenic effects and fish-habitat relationships in conservation planning." Canadian Journal of Fisheries and Aquatic Sciences **63**(7): 1596-1607.
- Bartz, K. K., K. M. Lagueux, et al. (2006). "Translating restoration scenarios into habitat conditions: an initial step in evaluating recovery strategies for Chinook salmon (*Oncorhynchus tshawytscha*)." Canadian Journal of Fisheries and Aquatic Sciences **63**(7): 1578-1595. Winter-run Chinook IOS and Delta Passage Model
 - Cavallo, B., P. Bergman, et al. (2011). Interactive Object-oriented Salmon Simulation (IOS) for the NODOS. Cramer Fish Sciences.
 - Cavallo, B., P. Bergman, et al. (2011). The Delta Passage Model. Cramer Fish Sciences. 21.
- WEAP – SALMOD
 - Bartholow, J., Heasley, J., et al. (2001). SALMOD: a population model for salmonids: user's manual. Version W3.
 - Fall Chinook Salmon Life Cycle Production Model Report to Expert Panel
 - Yates, D., D. Purkey, et al. (2009). "Climate Driven Water Resources Model of the Sacramento Basin, California." Journal of Water Resources Planning and Management **135** (5): 303-313.
 - Publications based on the WEAP model
<http://www.weap21.org/index.asp?doc=16>
- SLAM
 - <http://www.nwfsc.noaa.gov/trt/slam/slam.cfm>
- Steelhead Life-History Modeling
 - Satterthwaite, W. H., M. P. Beakes, et al. (2009). "Steelhead Life History on California's Central Coast: Insights from a State-Dependent Model." Transactions of the American Fisheries Society **138**(3): 532-548.
 - Satterthwaite, W. H., M. P. Beakes, et al. (2010). "State-dependent life history models in a changing (and regulated) environment: steelhead in the California Central Valley." Evolutionary Applications **3**(3): 221-243.

Additional Reports

- National Marine Fisheries Service Biological Opinions Page
- Summary Presentation - National Marine Fisheries Service, 2009 Biological Opinion on the California's Central Valley Project
- NMFS OCAP Effects Summary and RPA Actions

- National Research Council Committee on Sustainable Water and Environmental Management in the California Bay-Delta (2010). “A Scientific Assessment of Alternatives for Reducing Water Management Effects on Threatened and Endangered Fishes in California's Bay Delta”.
- CALFED Independent Review of a Draft Version of the 2009 NMFS OCAP Biological Opinion. January 2009.
- U.S. Fish and Wildlife Service Biological Opinion Page

Scope of the Workshop

This workshop panel will address four questions:

- 1) Which model(s) are most appropriate for informing NMFS of the effects of water operations and prescribed RPA actions on salmonids at various life stages and at the population level?
 - a) What are the strengths and weaknesses of the model(s)?
 - b) What are key parameters and performance measures captured in the model(s)?
 - c) How can this/these model(s) be applied to address the multiple timescales associated with RPA decisions and operations?
 - d) What are the technical constraints to the implementation of the model(s) and the feasibility to address them (e.g. transparency of the model, data set(s) availability, model parameter uncertainties and sensitivities, etc)?
- 2) How can multiple specific models be linked to represent the whole life cycle to inform NMFS in determining the effects of water operations and prescribed RPA actions on salmonids at the population level?
- 3) How well can the models be adapted for species other than what the model was originally developed?
- 4) How can the models best fit into a decision-making framework for using life cycle models (at appropriate temporal and spatial scales) to adapt water operations and prescribed RPA actions on individual and multiple species?

Products

The Independent Workshop Panel will prepare the following products according to the schedule outlined in its Scope of Work:

- A Final Workshop Report that addresses the scope of the workshop questions

Independent Workshop Panel Membership

- James Anderson, Ph.D., University of Washington
- Michelle McClure, Ph.D., NOAA, Northwest Fisheries Science Center
- Kenneth Rose, Ph.D., Louisiana State University
- Gregory Ruggerone, Ph.D., Natural Resources Consultants, Inc.

Workshop Format

The workshop will be a one-day event in Sacramento, CA. The majority of the workshop will involve presentations by model developers and experts. Workshop panel members may be asked to verbally provide a brief biographical sketch as it relates to the workshop. Following, the Lead Scientist or his designee will facilitate discussions.

Any questions raised by the panel for clarification prior to or during the workshop outside of the public meeting will be emailed to Lindsay Correa at the Delta Science Program (lindsay.correa@deltacouncil.ca.gov) who will disseminate questions as appropriate and email questions and answers to all the parties.